



National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material[®] 1889a

Portland Cement (Blended with Limestone)

This Standard Reference Material (SRM) is intended primarily for use in evaluating chemical methods of analysis and in the calibration of instrumental methods for analysis of cements and materials of similar matrix. A unit of SRM 1889a consists of four sealed vials, each containing approximately 5 g of portland cement ground to pass a 75 μm (No. 200) sieve.

Certified Values: The certified values for SRM 1889a, expressed as mass fractions [1] on an as-received basis, are provided in Table 1. A NIST certified value is a value for which NIST has the highest confidence in its accuracy, in that all known or suspected sources of bias have been investigated or accounted for by NIST. The certified values listed are based on the results of analyses performed at NIST, Construction Technology Laboratories, Inc. (CTL)¹, Skokie, IL, and the United States Geological Survey (USGS), Denver, CO, using X-ray fluorescence spectrometry, atomic absorption spectrophotometry, inductively coupled plasma emission spectrometry, and modified reference methods given in ASTM C 114-00 Standard Test Methods for Chemical Analysis of Hydraulic Cement [2]. Homogeneity testing was performed at NIST using X-ray fluorescence spectrometry. The uncertainty listed with each value is an expanded uncertainty, with coverage factor 2, calculated by combining a between-method variance [3] with a pooled, within-method variance following the ISO Guide [4].

Reference Values: A reference value for Cl expressed as mass fraction on an as-received basis is provided in Table 2. Reference values are noncertified values that are the best estimate of the true value; however, the values are based on determinations that do not meet the NIST criteria for certification and are provided with associated uncertainties that may reflect only measurement precision and may not include all sources of uncertainty.

Information Values: Information values for F, Insoluble Residue, Loss On Ignition (LOI), Free CaO, and the Total of all constituents are provided in Table 3. These are noncertified values with no uncertainty assessed.

Expiration of Certification: The certification of this SRM is valid until **01 March 2017**, within the uncertainty specified, provided the SRM is handled and stored in accordance with the instructions given in this certificate (see Use and Handling). However, the certification will be nullified if the SRM is damaged, contaminated, or modified.

The coordination of technical measurements for certification was accomplished under the direction of J.R. Sieber of the NIST Analytical Chemistry Division.

The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the NIST Standard Reference Materials Program by B.S. MacDonald.

Willie E. May, Chief
Analytical Chemistry Division

Gaithersburg, MD 20899
Certificate Issue Date: 13 February 2002

John Rumble, Jr., Acting Chief
Standard Reference Materials Program

¹Certain commercial organizations, services, equipment, or materials are identified in this certificate to specify adequately the experimental procedure. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the organizations, services, materials, or equipment identified are necessarily the best available for the purpose.

Statistical consultation for this SRM was provided by S.D. Leigh of the NIST Statistical Engineering Division.

Analytical measurements for certification of this SRM were performed by A.F. Marlow and J.R. Sieber of the NIST Analytical Chemistry Division; B. Angelakos, M. Bharucha, D. Broton, R. Naamane, S. Nettles, and C. Wedzicha of CTL, and J. Taggart and S. Wilson of the USGS.

Stability: This material is considered to be stable during the period of certification. NIST will monitor this material and will report any significant changes in certification to the purchaser. Return of the attached registration card will facilitate notification.

Use and Handling: Cement powder is hygroscopic and the following procedure is recommended. Samples should be used immediately after opening. To relate analytical determinations to the certified value in this Certificate of Analysis, a minimum sample mass of 500 mg is recommended. The vial should be recapped immediately and stored in a desiccator over magnesium perchlorate or phosphorus pentoxide. When a sample is used after storage in a previously opened vial, the LOI for that sample should be determined in accordance with ASTM C 114 and the weight of the sample corrected for any additional moisture, combined water, or carbonate above the LOI value reported in this certificate.

Reporting: The constituents listed in this Certificate of Analysis are expressed as the chemical forms and in the order given in ASTM C 114-00, Section 3, Table 1.

Table 1. Certified Values for SRM 1889a

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
SiO ₂	20.66 ± 0.16	K ₂ O	0.605 ± 0.015
Al ₂ O ₃	3.89 ± 0.12	TiO ₂	0.227 ± 0.010
Fe ₂ O ₃	1.937 ± 0.054	P ₂ O ₅	0.110 ± 0.004
CaO	65.34 ± 0.33	Mn ₂ O ₃	0.2588 ± 0.0073
MgO	0.814 ± 0.028	SrO	0.042 ± 0.004
SO ₃	2.69 ± 0.11	Cr ₂ O ₃	0.0072 ± 0.0005
Na ₂ O	0.195 ± 0.010	ZnO	0.0048 ± 0.0003

Table 2. Reference Values for SRM 1889a

Constituent	Mass Fraction (%)
Cl	0.0019 ± 0.0003

Table 3. Information Values for SRM 1889a

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
F	0.05	Insoluble Residue	0.66
LOI at 950 °C	3.28	Free CaO	0.58
Total ^a	100.09		

^a A correction has been made for the amount of fluoride present. This correction, which was subtracted from the gross total, was determined by multiplying the percent fluoride by the ratio of the atomic weight of oxygen to the molecular weight of fluorine (0.421). The Total does not include Insoluble Residue, or Free CaO.

REFERENCES

- [1] Taylor, B.N., "Guide for the Use of the International System of Units (SI)," NIST Special Publication 811, 1995 Ed., (April 1995).
- [2] ASTM C 114-00, Standard Test Methods for Chemical Analysis of Hydraulic Cement, *Annu. Book ASTM Stand.*, **04.01**, West Conshohocken, PA.
- [3] Levenson, M.S., Banks, D.L., Eberhardt, K.R., Gill, L.M., Guthrie, W.F., Liu, H.K., Vangel, M.G., Yen, J.H., and Zhang, N.F., "An Approach to Combining Results from Multiple Methods Motivated by the ISO GUM," *J. Res. Natl. Inst. Stand. Technol.*, **105**, pp. 571-579, (2000).
- [4] *Guide to the Expression of Uncertainty in Measurement*, ISBN 92-67-10188-9, 1st Ed., ISO, Geneva, Switzerland, (1993); see also Taylor, B.N. and Kuyatt, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results," NIST Technical Note 1297, U.S. Government Printing Office, Washington DC, (1994); available at <http://physics.nist.gov/Pubs/>.

Users of this SRM should ensure that the certificate in their possession is current. This can be accomplished by contacting the SRM Program at: telephone (301) 975-6776; fax (301) 926-4751; e-mail srminfo@nist.gov; or via the Internet <http://www.nist.gov/srm>.